



Summary

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Methodological News contains articles on a range of topics across different areas within the Methodology Division in the ABS. This issue contains two articles, Using State Space Models to Assist Confrontation of Business Statistics and National Accounts, and Introducing an efficient new method for predicting small area values: the Stratified Reweighting Estimator.

Using State Space Models to Assist Confrontation of Business Statistics and National Accounts

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The ABS has previously communicated on the potential use of State Space Models, in particular Seemingly Unrelated Time Series (SUTSE) models, for measuring impacts introduced into statistical outputs by its transformation program. Changes to the design of the questionnaire forms and data collection procedure are two potential causes of statistical impact during transformation.

While the use of SUTSE models so far has been primarily focussed on impact measurement, these models could be used more widely as part of the quality assurance processes that happen during regular statistical production.

As such, Methodology has started developing time series models to produce forecasts of key economic statistics, and are working with the Quarterly Economy Wide Surveys (QEWS) area and the National Accounts compilation team to trial incorporating model forecasts as part of quality assurance. The idea is that analysis of the model outputs will be incorporated into the regular production process, and they will be used before, during and after process changes happen through transformation.

An initial case study has explored forecasting Private New Capital Expenditure on Equipment, Plant and Machinery. The Capital Expenditure (Capex) survey collects not only actual expenditure in the reference quarter, but also expectations of future expenditure. Analysis has shown that the series on expectations have considerable correlation with the actual expenditure series, through their long-term trends, with a leading lag. An historical analysis assessed the performance of the forecasts produced by alternative models in recent years. SUTSE models, which exploit this correlation between expected and actual expenditure, had lower average prediction errors compared to a time series model based on only the time series of actual expenditure.

The models that have been built provide forecasts and 95% prediction intervals, which can be used as an objective way to assess the extent to which an observed estimate is consistent with both the historical behaviour of the time series itself, and the related series. The outputs provide an additional source of information to complement existing processes used for validation. Use of these outputs for quality assurance purposes was trialled in real-time for the Capex survey for the first time for June quarter 2019 estimates.

Next steps of this work are to review how the forecasts were used as part of the regular production process, identify any improvements to the model and presentation of the model outputs, and to extend to other key economic time series.

The author would welcome any feedback, particularly on methods for identifying related variables which can improve forecasts for key economic indicators, and the use of forecasts as part of quality assurance.

For more information or to provide feedback, please contact Jennie Davies Methodology@abs.gov.au

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Introducing an efficient new method for predicting small area values: the Stratified Reweighting Estimator

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Knowing the population characteristics in a local area is important for many policy makers. We would like to provide small area estimates as a standard output from our household surveys; however there are two main problems. First, direct survey methods, which use only the local sample in an area, yield very unstable predictions. Second, current methods use tailored statistical modelling methods which, while producing high quality estimates, are also time and resource intensive.

The stratified reweighting estimator (SRE) is designed to enable efficient production of small area predictions for a large range of survey variables.

How the SRE estimator works:

The following steps are applied to a survey unit record file to produce a single large file in which the survey records can appear many times representing different small areas (known as SA2s).

1. Copy records: Each SA2 belongs to a "stratum" of similar SA2s from across Australia. The survey records from the whole stratum are copied to represent that single SA2 on the output file.
2. Assign initial weights: The records for an SA2 are assigned weights that add to the SA2 Census count. The weights are larger for units from nearby SA2s (those in the same SA4).
3. Adjust weights to represent each small area's Census demographics: Records within each SA2 are weighted to add to a range of Census demographic counts. This captures peculiarities of the SA2 as measured at Census time.
4. Adjust whole file to represent survey estimates: The whole file is finally weighted to reproduce a suite of key survey estimates and demographic totals at Australia level. This is a critical step both in representing the survey time point and in adjusting for the impact of differential non-response.

The resulting weighted file can then be used to generate small area estimates for any survey variable or combination of variables.

Quality assessment for the reweighting approach is based on stability and model goodness-of-fit, and measures of these are provided for each survey variable. Stability is measured by taking the median value (over the small areas) of the Jackknife estimates of the relative standard error (RSE). The model goodness-of-fit is measured by a standardised Wald statistic that estimates how well the SRE predictions fit the survey estimates for each target variable. These two measures, along with knowledge of the predictors used in the model, will enable users to determine if the SRE provides fit-for-purpose predictions for a target variable.

Methodology have used the 2015 Survey of Disability, Aging and Carers to develop and test the SRE, and we are now partnering with our ABS subject matter colleagues to begin implementing the SRE for small area prediction in our household surveys.

For more information, please contact Sean Buttsworth Methodology@abs.gov.au

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Methodological News features articles and developments in relation to methodology work done within the ABS Methodology Division. By its nature, the work of the division brings it into contact with virtually every other area of the ABS. Because of this, the newsletter is a way of letting all areas of the ABS know of some of the issues we are working on and help information flow. We hope the Methodological Newsletter is useful and we welcome comments.

If you would like to be added to or removed from our electronic mailing list, please contact:

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About this Release

Methodological News is a quarterly information bulletin from the Methodology Division. The newsletter features articles and developments in relation to work done with the division.

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